

**BECK & TYSVER, P.L.L.C.**2900 THOMAS AVE. SOUTH, SUITE 100  
MINNEAPOLIS, MN 55416-4477ROBERT C. BECK  
DANIEL A. TYSVERFAX: (612) 915-9637  
PHONE: (612) 915-9633STEPHANIE J. JAMES  
JAMES C. EVANS**Facsimile Transmittal****NUMBER OF PAGES:** 15 (INCLUDING COVER SHEET)**TO:**

*Name:* Examiner Paul Kang  
*Company:* USPTO  
*Fax:* 571-273-3882  
*Phone:* 571-272-3882

**FROM:**

*Name:* Daniel A. Tysver  
*Phone:* 612-915-9633

**DATE:**

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Message to Recipient:

Re: United States Patent Application  
Inventor: Steven R. Soltis  
Title: Shared File System  
Ser. #: 10/738,371  
Our Reference: 3000

Enclosed is a proposed examiner's amendment for the above-referenced patent application.

10/738,371

PATENT

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Steven R. Soltis	Examiner:	Paul H. Kang
Serial No.:	10/738,371	Group Art Unit:	2444
Filing Date:	12/16/2003	Docket No.:	3000
Title:	Shared File System		

## PROPOSED EXAMINER'S AMENDMENT

Commissioner for Patents  
Alexandria, VA 22313

The examiner has indicated through a telephone conference that some of the claims in the above-referenced case are in condition for allowance. These claims are based upon independent claims 1, 9, 23, and 37. Other claims that are not in condition for allowance are based upon independent claims 31, 43, 50, 52, 54, and 57. As explained by the examiner, the claims that are in condition for allowance include three specific claim limitations: i) a distinction between a client and server computer, ii) a limitation that the namespace is managed by the server, and iii) a limitation that the client issues a namespace request to the server computer. The following is a proposed Examiner's Amendment that the applicant would accept in order to move this application to allowance.

### PROPOSED AMENDMENTS TO CLAIMS

1. **(Previously Presented)** A distributed file system residing on a plurality of computers, the distributed file system having a namespace defining a directory structure of files and metadata that includes pointers to real-data, the file system comprising:
  - a) at least one server computer running server software for managing the namespace;
  - b) a network; and
  - c) at least one client computer located separately from the server computer and in communication with the server computer over the network, each running client software, the client software
    - i) issuing namespace requests to the server computer over the network, each namespace request consisting of a filename and an operation encoded into a protocol interpretable by the server computer, the namespace requests selected from the group consisting of requests to add new filenames to the namespace, requests to remove existing filenames from the namespace, and requests to search the namespace for filenames, and
    - ii) directly retrieving, analyzing, and altering the metadata.
2. **(Original)** The file system of claim 1, wherein metadata includes allocation tables that store information identifying data as allocated and not allocated.
3. **(Original)** The file system of claim 1, wherein the client software directly generates metadata pointers to real-data.
4. **(Original)** The file system of claim 1, wherein the server software enforces file access permissions.
5. **(Previously Presented)** The file system of claim 1, wherein the server software manages the namespace in response to namespace requests from the client computer, including requests to read a directory from the namespace.

6. **(Original)** The file system of claim 5, wherein the namespace search for filenames returns information necessary to retrieve the metadata.
7. **(Original)** The file system of claim 6, wherein the server software enforces file permissions during the namespace search.
8. **(Previously Presented)** The file system of claim 1, wherein the client computer directly responds to file system requests concerning a file from an application program.
9. **(Previously Presented)** A network of connected computing devices for implementing a shared storage distributed file system, the file system having a namespace, real-data, and metadata, the network comprising:
  - a) a network storage device connected to a the network;
  - b) a server computer that manages the namespace by retrieving and modifying directory files in response to namespace requests, including requests to add new filenames to directory files and to remove existing filenames from directory files; and
  - c) a client computer in network communication with the server computer and the network storage device, wherein the client computer
    - i) issues namespace requests to the server computer over the network communication,
    - ii) reads and writes the real-data directly from the network storage device, and
    - iii) creates, retrieves, and modifies the metadata.
10. **(Original)** The network of claim 9, wherein the client computer communicates with the server computer via a local area network, and the client computer communicates with the network storage device via a storage area network.
11. **(Original)** The network of claim 10, wherein namespace requests are communicated via the local area network.
12. **(Original)** The network of claim 10, wherein the client reads and writes the real-data via the storage area network.
13. **(Original)** The network of claim 9, wherein the client computer requests file attributes from the server computer.

14. **(Original)** The network of claim 13, wherein file attributes are communicated via the local area network.
15. **(Original)** The network of claim 9, wherein the client computer acquires a lock prior to modifying the metadata.
16. **(Original)** The network of claim 9, wherein the namespace requests include requests to search the namespace for filenames.
17. **(Original)** The network of claim 16, wherein the server computer enforces file access permissions during the namespace search.
18. **(Original)** The network of claim 9, wherein the client computer stores the metadata by requesting that the metadata be stored by the server computer.
19. **(Original)** The network of claim 18, wherein the server computer stores the metadata within a real-data file.
20. **(Original)** The network of claim 18, wherein the server computer is operating as the server of a client-server file system to store the metadata.
21. **(Original)** The network of claim 18, wherein the server computer stores the metadata on a server storage device locally attached to the server computer.
22. **(Original)** The network of claim 18, wherein the server computer stores the metadata on a server storage device different from the network storage device.
23. **(Previously Presented)** An improved file system operating as part of a client computer comprising:
  - a) a digital communication path to a storage device;
  - b) a network communication path to a server computer operating a server software program that maintains a namespace by receiving a namespace request from the client computer, reading the directory file corresponding to the request from the storage device, modifying the directory file, and writing the directory file to the storage device; and
  - c) a client software program that runs on the client computer that responds to file system requests from an application program concerning a file, wherein the client software

- i) obtains addressing metadata containing at least one pointer addressing real-data for the file,
  - ii) uses the addressing metadata to locate real-data associated with the file on the storage device,
  - iii) alters the addressing metadata for the file; and
  - iv) submits namespace requests across the network communication path to the server computer.
24. (Original) The improved file system of claim 23, wherein the server software adds new filenames to the namespace, removes existing filenames from the namespace, and searches the namespace for filenames.
25. (Original) The improved file system of claim 24, wherein the client software sends a namespace search request to the server software in order to obtain addressing metadata.
26. (Original) The improved file system of claim 25, wherein the server software enforces file access permissions during the namespace search.
27. (Original) The improved file system of claim 25, wherein the addressing metadata is found within an inode obtained by the client software.
28. (Original) The improved file system of claim 23, wherein the client software further obtains allocation table metadata concerning allocation of storage on the storage device and modifies the allocation table metadata when performing file allocation and de-allocation.
29. (Original) The improved file system of claim 28, wherein the allocation table metadata is a bitmap table.
30. (Original) The improved file system of claim 23, wherein the addressing metadata is found within an inode obtained by the client software.
31. (Currently Amended) An improved file system operating on a client computer and a server computer to access a storage device containing real-data and one or more direct pointers addressing the real-data, the improved file system comprising:
- a) a server software program residing on the server computer, the server software program
    - i) maintains a namespace defining a directory structure of files on the storage device.

- ii) services namespace requests from the client computer, and
  - iii) stores an indirect pointer within the namespace related to a file, the indirect pointer addressing at least one file related direct pointer on the storage device; and
- b) a client software program residing on the client computer, the client computer being located separately from the server computer and issuing namespace requests to the server computer, the client software program responds to file system requests from an application program concerning the file; the client software program further
- i) obtains the indirect pointer for the file from the server software program,
  - ii) uses the indirect pointer to obtain the file related direct pointer directly from the storage device, and
  - iii) uses the file related direct pointer to read and write real-data associated with the file directly from the storage device.
32. (Original) The improved file system of claim 31, wherein the client software program modifies the file related direct pointer during file write operations.
33. (Original) The improved file system of claim 32, wherein the client software acquires a lock prior to modifying the file related direct pointer.
34. (Currently Amended) The improved file system of claim 31, wherein the server software services namespace requests from the client computer, including include requests to add new filenames to the namespace, to remove existing filenames from the namespace, and to search the namespace for filenames.
35. (Original) The improved file system of claim 31, wherein the client software further obtains allocation table metadata concerning allocation of storage on the storage device and updates the allocation metadata when performing file allocation and de-allocation.
36. (Original) The improved file system of claim 35, wherein the client software acquires a lock prior to updating the allocation table metadata.

37. **(Previously Presented)** A client computer having an improved file system, the file system providing access to data stored on a storage device, comprising:
  - a) a network connection to a server computer that is located separately from the client computer and that maintains a namespace defining a directory structure of files on the storage device, and
  - b) client software residing and operating on the client computer that
    - i) obtains allocation information concerning the allocation of storage on the storage device,
    - ii) alters the allocation information for regular files during file allocation and de-allocation, and
    - iii) submits namespace requests to the server computer over the network connection;  
wherein the alteration of the allocation information is performed in response to a request by an application program running on the client computer.
38. **(Previously Presented)** The improved file system on the client computer of claim 37, wherein the server software accesses and modifies the directory structure in response to namespace requests from the client computer, including requests to add new filenames to the namespace, to remove existing filenames from the namespace, and to search the namespace for filenames.
39. **(Previously Presented)** The improved file system on the client computer of claim 37, wherein the client software acquires a lock prior to obtaining the allocation information.
40. **(Previously Presented)** The improved file system on the client computer of claim 37, wherein the client software further:
  - iii) obtains addressing metadata locating real-data for a particular file,
  - iv) uses the addressing metadata to access real-data associated with the particular file on the storage device, and
  - v) alters the addressing metadata for the file.

41. **(Previously Presented)** The improved file system on the client computer of claim 40, wherein the client software acquires a lock prior to altering the addressing metadata.
42. **(Previously Presented)** The improved file system on the client computer of claim 37, wherein the allocation information is obtained from the storage device and the altered allocation information is stored on the storage device.
43. **(Currently Amended)** A network of connected computer devices comprising:
  - a) a first computer running software for
    - i) managing a ~~directory structure~~ namespace of files, and
    - ii) servicing namespace ~~directory~~ requests, the namespace ~~directory~~ requests including requests to add filenames to the ~~directory~~ namespace, remove filenames from the ~~directory~~ namespace, and search the ~~directory~~ namespace; and
  - b) a second computer located separately from the first computer and running software for
    - i) submitting to the first computer namespace ~~directory~~ requests relating to a file request, and
    - ii) analyzing and altering metadata relating to the file request, the metadata including pointers to real-data.
44. **(Original)** The network of claim 43, wherein the metadata includes data allocation information.
45. **(Original)** The network of claim 43, wherein the second computer directly responds to file requests from an application program.
46. **(Original)** The network of claim 43, wherein the first computer enforces file access permissions for requests received from the second computer.
47. **(Original)** The network of claim 46, wherein the first computer enforces file access permissions while adding a filename to a directory.
48. **(Original)** The network of claim 46, wherein the first computer enforces file access permissions while removing a filename from a directory.
49. **(Original)** The network of claim 46, wherein the first computer enforces file access permissions while searching for a filename within a directory.

50. **(Canceled)** A method for handling a file request from an application, the file request relating to real-data of a file, the real-data being stored on a network connected storage device, the method comprising:
  - a) receiving the file request from the application at a client computer;
  - b) requesting an indirect extent pointer for the file from a server computer located separately from the client computer;
  - c) receiving the requested indirect extent pointer at the client computer;
  - d) using the indirect extent pointer to retrieve metadata from the storage device;
  - e) for a file read request, the client computer
    - i) analyzing the metadata to determine the locations of the real-data stored on the storage device, and
    - ii) reading the real-data from the storage device; and
  - f) for a file write request, the client computer
    - i) analyzing the metadata to determine the locations of the real-data stored on the storage device,
    - ii) allocating additional storage space to the file,
    - iii) writing real-data to the storage device,
    - iv) updating metadata, and
    - v) storing updated metadata on the storage device.
51. **(Canceled)** The method of claim 50, wherein during the allocation of additional storage space for the file write request, the client computer retrieves, analyses, and modifies the allocation table metadata.
52. **(Currently Amended)** A method for handling file requests by a file system comprising:
  - a) receiving the file request at a client computer;
  - b) requesting at the client computer that a server computer located separately from the client computer which manages a namespace for the file system perform a namespace search for the file of the request, the server computer being located separately from the client computer;

- c) analyzing and altering metadata relating to the location of real-data of the file request at the client computer; and
  - d) saving on a storage device the metadata altered by the client computer.
53. (Original) The method of claim 52, wherein a lock is acquired prior to altering the metadata relating to the location of real-data.
54. (Currently Amended) A method for handling file requests by a file system comprising
- a) receiving the file request at a client computer;
  - b) requesting at the client computer namespace data relating to the file request from a server computer, the server computer managing a namespace for the file system and the server computer also being located separately from the client computer;
  - c) analyzing and altering metadata at the client computer, the metadata relating to the allocation information of storage on a storage device; and
  - d) saving on the storage device the allocation information metadata altered by the client computer.
55. (Original) The method of claim 54, wherein the allocation information consists of bitmap tables.
56. (Original) The method of claim 54, wherein a lock is acquired prior to analyzing and altering allocation information metadata, and the lock is released after saving the allocation information.
57. (Currently Amended) A computer product, comprising:  
a tangible non-transitory computer readable medium having a computer program code embodied therein, said computer program code adapted to be executed to implement a method for handling file requests by a file system, the method comprising:
- a) receiving the file request at a client computer;
  - b) requesting at the client computer that a server computer located separately from the client computer which manages a namespace for a file system perform a namespace search for the file of the

request, the server computer being located separately from the client computer;

- c) analyzing and altering metadata relating to the location of real-data of the file request at the client computer; and
  - d) saving the metadata altered by the client computer.
58. **(Currently Amended)** The file system of claim 1, wherein the file system is a shared storage distributed file system in which the client computer directly accesses the shared storage device.
59. **(Canceled)** The network of claim 50, wherein the storage device is a shared storage device, whereby the client computer directly access the shared storage device.

**REMARKS****Status of Claims:**

If this proposed Examiner's Amendment were accepted, claims 1-49 and 52-58 would be pending. Claims 31, 34, 43, 52, 54, 57, and 58 would be amended by this amendment. Claims 50, 51, and 59 would be cancelled.

**Proposed Amendment**

The examiner has indicated that independent claims 31, 43, 50, 52, 54, and 57 lacked the elements that made independent claims 1, 9, 23, and 37 patentable over the prior art. The applicant submits that these elements will be added by the proposed amendments to claims 31, 43, 52, 54, and 57. In each case, these independent claims now include limitations relating to i) the separate location of the computers, ii) the maintenance of the namespace by the server or first computer, and iii) the submission of namespace requests from the client or second computer to the server or first computer.

Claim 31 is altered by the proposed amendments and now explicitly includes these elements. Claim 34 is amended above to reflect the fact that some of the limitations of dependent claim 34 now appear in independent claim 31. In claim 43, the applicant submits that a directory request is a namespace request. To clarify this point, the claim will now read that the second computer submits to the first computer "namespace directory requests." Other amendments to claim 43 add a limitation that the first computer manages the namespace for the directory structure of files. As obvious from the language of this claim, it differs from the claims that were indicated to be allowable by the examiner in part because the "server computer" is replaced by the phrase "first computer," and the "client computer" is replaced by the phrase "second computer." As has been discussed during prosecution, the distinction between a "client" and a "server" is difficult to make without reference to the functions being performed by each computer. Consequently, the applicant submits that this distinction in claim 43 does not change the distribution of the explicitly claimed functions for each computer, and therefore claim 43 is patentable along with the other pending claims. Claims 52 and 57 already relate to a "namespace search" request while

claim 54 relates to a request for "namespace data." The proposed amendments to claims 52, 54, and 57 add a requirement that the server computer manages the namespace for the directory structure of files. The proposed amendments to these three claims also explicitly state that the specific namespace requests originate at the client computer and are made to the server computer. Claim 58 has been amended to correct a typographical error.

Claim 50 defines an invention that the applicant believes is patentable over the prior art. This claim is not susceptible to easy modification to include the elements discussed by the Examiner. Unless the Examiner is able to accept that claim 50 is patentable over the prior art as written, the applicant is willing to cancel independent claim 50 and dependent claims 51 and 59 to move the application toward issuance on the other claims.

Finally, the applicant wishes to reiterate that the "located separately from" language used to distinguish the server from the client computers (or the "first" computer from the "second" computer in claim 43) was added pursuant to the examiner's suggestion to clarify that these computers are separate computers (for instance, that they are separately addressable on a network). The claim language is not intended to indicate that any particular amount of physical distance exists between the two computers. For example, the two computers could coexist on the same rack, or could be placed physically side-by-side. If the examiner disagrees with this interpretation of the claim language, the applicant respectfully requests a chance to amend the claim language to further comply with the express intent of applicant.

**CONCLUSION**

All of the claims remaining in this application should now be seen to be in condition for allowance. The prompt issuance of a notice to that effect is solicited.

Respectfully Submitted,

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Daniel A. Tysver  
Registration No. 35,726  
Beck & Tysver, P.L.L.C.  
2900 Thomas Avenue South, #100  
Minneapolis, MN 55416  
Telephone: 612-915-9634  
Fax: (612) 915-9637